APPENDIX A
STORMWATER COMPOSITE SAMPLING SOP

STORMWATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting flow weighted composite stormwater samples from freshwater environments using a Teledyne/Isco (Isco) automatic sampler.

This SOP utilizes and augments some of the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). While some of these exact procedures are not used, because they are not necessary for this FSP, the clean techniques described in this guidance were used to assist in developing a series of procedures that will minimize the possibility for sampling contamination of samples. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by programs that follow these guidelines.

While the above procedures were intended for sampling for trace metals, using these procedures for organic compounds as well as conventionals (such as total suspended solids (TSS), dissolved organic carbon (DOC), and dissolved suspended solids) provides a means to minimize the possibility of sample contamination in general.

SUMMARY OF METHOD

Flow-weighted composite samples of three storm events from each location will be collected to obtain Event Mean Concentrations (EMCs) of constituents of interest (COIs). Flow-weighted, whole water (unfiltered) sample aliquots will be collected over the course of the storm event with automatic samplers. These whole water samples will be collected by the sampling teams, identified in Section 4 of the FSP, and transported to the LWG Field Laboratory. Samples will be collected from the sampler using the two-person clean sampling techniques similar in concept to the "clean hands – dirty hands" method (EPA 1996). Field samples will then be transported to the LWG Field Laboratory

At the LWG Field Laboratory, sampler performance will be evaluated and the water from the individual sample bottles will be combined and mixed in a single container. Following sample compositing in the mixing containers, appropriate sample bottles, with preservative, if applicable, will be filled using a peristaltic pump. The sample containers will be capped, labeled, and then placed inside a cooler for transport to the analytical laboratory.

Whole water samples for organic compounds, and unfiltered/filtered water pairs for metals and total organic carbon (TOC)/DOC, will be prepared by the sampling teams from the combined composite sample. Samples will also be prepared for analysis of TSS concentrations. Each sample will be analyzed for the chemicals shown in Tables 2-2 and 2-3 of the FSP.

The samples will be handled following the procedures described in the Chain of Custody SOP (Appendix F).

SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. A detailed supply and equipment list is provided in Table A-1. Additional equipment may be required depending on the sample site.

An Isco Model 6712 automated sampler unit will be deployed at each sampling location. The sampler will be equipped with glass sample bottles and a Teflon screen and Teflon sampling tube. Each sampler will be equipped with a cellular modem and area/velocity (AV) type flow meter. Additionally, a minimum 50 amp hour GSM deep cycle battery will be used to power the sampler, stainless steel mounting brackets will be used to mount the flow sensor and sampling tube and hang the battery and sampler in the catch basin.

Table 1-1. Composite Sampling Equipment Required per Sampling Site

Equipment Item	**Number Required**
Isco 6712 Sampler	1
Sampler base to hold eight 1.8-liter sample bottles	1
Isco 1.8 liter sample bottles and Teflon lined caps	24
Teflon coated stainless steel pick up screen	1
Teflon intake tube	1
750 Flow module	1
Cell phone modem package	1
Remote power supply cable	1
12-volt 50-amphour GSM deep cycle battery	1
Mounting hardware (varies by site) to secure flow probe and pick up screen.	1
Mounting hardware to Isco sampler and battery (varies by site)	1
Box nitrile gloves	1
Cooler with foam dividers	1

Additional equipment for the processing and filtering (as appropriate) of samples in the Field Laboratory are noted in the procedures and collection sections below.

PROCEDURES

EQUIPMENT DECONTAMINATION

Each sampling team will be responsible for preparing their equipment prior to the sampling event. Sampling bottles and equipment will be decontaminated either by commercial laboratories noted in the FSP following their internal procedures and "certified clean" by those laboratories, or decontaminated at the Field Laboratory by the field teams, as necessary. The Field Laboratory decontamination procedures are described below.

Teledyne Isco Glass Sample Bottles

- Dishwasher cycle (wash and tap water rinse).
- One spectro-grade acetone rinse.
- Acid wash with at least 20 percent hydrochloric acid.
- Rinse three times with DI water.
- Replace in covered Teledyne Isco tubs.

Teflon Suction Line

- Rinse twice with spectro-grade acetone.
- Rinse thoroughly with hot tap water using a brush, if possible, to remove particulate matter and surface film.
- Rinse thoroughly three times with tap water.
- Acid wash with at least 20 percent hydrochloric acid.
- Rinse thoroughly three times with tap water.
- Rinse thoroughly three times with DI water.
- Rinse thoroughly with petroleum ether and dry by pulling air through the line.
- Dry overnight in a warm oven (use an oven temperature of lower than 150° F), if possible.
- Cap ends with aluminum foil.

Teledyne Isco Pump Tube

- Rinse by pumping hot tap water through the tube for at least 2 minutes.
- Acid wash the tube by pumping at least a 20 percent solution of hydrochloric acid through the tube for at least 2 minutes.
- Rinse by pumping hot tap water through the tube for at least 2 minutes.
- Rinse by pumping distilled water through the tube for at least 2 minutes.

Teledyne Isco Sampler

The sampler top cover, center section, retaining ring, and tub of the automatic sampler will be cleaned with warm soapy water and rinsed with tap water. The two pump drain holes will be checked to see that they are open and free of debris or buildup.

During implementation of the FSP, it is not anticipated that screens and intakes tubes will be removed for cleaning between sampling events. The sampler will be programmed to purge the intake tubes several times before and after each stormwater sample is collected, which should ensure that any contamination from previous events is removed or sufficiently diluted to be unimportant. If upon routine inspection, it is observed that algae is growing in the intake tube, debris is blocking the tube, or any other gross contamination issues may exist, it will be replaced with a tube and screen decontaminated using the methods described previously.

Sampler Mounts and Other Equipment

Mounting equipment such as slip rings, nuts and bolts, brackets will be washed with warm soapy water using a brush to remove any oil, grease or other residue from the manufacturing process. They will then be rinsed with spectro-grade acetone and then with DI water and allowed to dry. A warm oven could be used to speed drying.

When installing the brackets in the field at the sampling sites, it may be necessary to drill holes or use powder actuated tools to set studs, weld, or use other means to attach the sampling hardware that may create some debris that could become a contaminant source. After the studs are set or other procedures are complete, the work site will be scrubbed with a brush to remove any debris and rinsed with DI water before the sampling hardware (intake screen) is mounted.

Coolers used to transport samples will be washed with warm soapy water using a brush to remove any residue and rinsed with tap water prior to collecting samples.

Sample Containers

Sample containers will be certified pre-cleaned containers obtained through the laboratory.

Phthalate Free Procedures

For locations where phthalates will be sampled the procedures followed will be identical to those noted above with the following exceptions. During all decontamination procedures equipment will be handled with powder and phthalate free vinyl gloves and will not be placed on any plastic or rubber surfaces (decontaminated stainless steel surfaces are preferred). Once decontaminated, Isco and sample bottles will be place in _____ containers before placing in coolers for transport. [We are continuing to determine the best material to place bottles in for transport to avoid contamination cooler and packing plastics].

Isco sampler tube and pumping connection systems will be checked for any plastic components that might come into contact with sample water and will be removed from the collection system to the extent practicable and/or replaced with either non-contact systems or alternate materials as feasible. Any potential sources of plastic or rubber contact that cannot be removed will be noted in the sampling report.

During field sampling procedures bottles and any equipment potentially coming into contact with sample water will be handled with powder and phthalate free vinyl gloves. Sample bottles will not be placed on any plastic or rubber surfaces during sample processing (decontaminated stainless steel surfaces are preferred). Once the sample bottles are filled after sample processing, they will be capped with Teflon lids and place in _____ containers before placing in coolers for transport.

STORMWATER SAMPLE COLLECTION

Clean Handling Techniques

The clean handling techniques are modeled after the “clean hands – dirty hands” method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean” (C) and a second person as "dirty" (D). Although specific tasks are assigned at the start to C or D, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both C and D wear appropriate non-contaminating, disposable, powderless gloves (including phthalate free vinyl gloves for any locations where phthalates will be sampled) during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

C takes care of all operations that involve equipment that comes into contact with the sample, and under the covered portions of the automatic sampler including the following responsibilities:

- Handles the stormwater sample bottles (removes and replaces)
- Handles sample bottles until they are placed and sealed into coolers
- Prepares a clean workspace in LWG Field Laboratory
- Sets the equipment (i.e., the sample bottles and the filtration and preservation equipment) inside the laboratory

D takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the samplers
- Removes samplers from catch basins, if necessary, and releases catches and lifts of sampler cover for C.
- Replaces cover and latches sampler covers
- Handles the tools, such as hammers, wrenches, keys, and locks
- Handles the single or multi-parameter instruments for field measurements.
- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.
- Sealed coolers.

Stormwater Sampling Procedures

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing as well as assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for recording stormwater parameters.

When collecting the water samples from the Isco samplers, the D person and assistant will remove the manhole or catch basin lid and the C person will clear a work space and lay down a plastic sheet. The D person will place the sampler on the plastic sheeting and release the catches on the sampler and lift away the cover standing it on the plastic sheeting. The C person will inspect the inside of the sampler for signs of wear or debris. The C person will then install Teflon lined caps on each of the sample bottles. The C person will remove each sample bottle in turn, then label it with a water proof label, and

place it a cooler with foam dividers. Samples for phthalates analyses will be placed in ___ containers prior to placement in coolers.

After the samples have been processed, the C person installs new "Certified Clean" sample bottles in the sampler. The D person will replace the cover and latch the fasteners. The D person and assistant and will replace sampler in the catch basin and close and lock the lid if applicable.

SAMPLE PROCESSING

Once a stormwater sample container is properly closed, and labeled, the C person places inside a cooler with foam dividers containing wet ice. Samples for phthalate analyses will be placed in ____ containers before placing in coolers.

All samples are stored in sealed coolers with wet ice and transferred to the LWG Field Laboratory at the conclusion of the sampling event. Personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the sample containers with clean non-contaminating gloves (including use of phthalate free vinyl gloves for samples from any location requiring phthalate analyses), and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored weekly to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Sample Compositing and Transfer to Sample Bottles for Laboratory Analysis

As part of the field sampling procedures, the sampling team will download the sampling report and flow data from the data logger. The field collected samples will be transported to the LWG Field Laboratory and left in their respective coolers, or refrigerated, until the sampling report and flow data can be reviewed. If the sampling report and flow data indicate that there was no malfunction and all the sample bottles are intact, the compositing and sample preparation would continue as follows.

The samples would be emptied into a large sample container, decontaminated in the same manner as described previously for the Isco glass sample bottles and mixed (i.e., using a churn splitter or other suitable apparatus). Samples for phthalate analyses will be mixed with manually with a decontaminated stainless steel rod held by a person wearing phthalate free vinyl gloves. Following sample compositing in the mixing containers, appropriate sample bottles, with preservative if applicable, will be filled using a

peristaltic pump. (The pump tube will be decontaminated in the same manner as described previously for the Isco pump tube). The sample containers are capped, labeled, and placed inside a cooler with foam dividers for transport to the analytical laboratory. Samples for phthalate analyses will be placed in ____ containers prior to placement in the cooler.

Whole water samples for organic compounds, and unfiltered/filtered water pairs will be prepared for metals and TOC/DOC by the sampling teams from the combined composite sample. Metals and DOC filtered samples will be prepared by peristaltic pumping water from the composite container (using the same clean tube as described above) through a 0.45 micron filter and the directly into metals and DOC sample bottles, again via a clean pump tube. In general, new decontaminated equipment including composite containers, pump tubing, and filters will be used for the filtering at each new location sample processed in the Field Laboratory to prevent cross contamination between samples.

Samples will also be prepared for analysis of TSS concentrations. Each sample will be analyzed for the chemicals shown in Tables 2-2 and 2-3 of the FSP.

Contingencies

Several problems could occur that may affect the viability of a sample collected. Common potential problems and contingencies are as follows.

1. Sample volume is not adequate for all of desired analyses. This may occur when the forecasted precipitation is substantially greater than the actual site precipitation. Under these sampling conditions, the sample will be composited as normal and samples for analyses will be prepared in the priority shown in Table 2-3 of the FSP.

2. Sample exceeds bottle capacity. The sampler report indicates that the bottle capacity was exceeded. This may occur when the forecasted precipitation is substantially less than the actual site precipitation. In this case the flow data will be evaluated; if the collected samples represent 50 percent or greater of the total storm and encompass some of the falling limb of the storm, the total volume will be composited and analyzed per normal procedure. If the sample volume represents less than 50 percent of the total storm volume, it should be composited and held at the LWG Field Laboratory under conditions shown in Table 3-2 of the FSP for possible later analyses in the event that no further storm events can be successfully captured.

3. A portion of the sample is lost. This would occur when one or more of the sampling bottles is damaged or the sampler malfunctions. In this situation, the sampling report and flow data will be reviewed to determine what representative portion of the storm volume is missing. In this situation it may be possible that a significant portion of the storm was not sampled, and/or there is not adequate volume to complete the desired analyses. Following the process of the two

previous scenarios, if the sample includes sample that represents 50 percent of the storm and both rising and falling limb conditions are included, then the sample will be used. If not, it will be archived at the Field Laboratory as described above. If the sample meets the above conditions but the volume is inadequate to conduct all analyses, the sample containers will be filled in the priority order of analyses shown in Table 2-3 of the FSP.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples will be collected at the frequencies presented in the Section 3.8 of the FSP. The sampling program is designed to collect additional volume for field and laboratory QC samples. The QC program for water samples includes:

- Field duplicates, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Equipment rinsate blank for all analyte groups, 1 per 20 samples.

The types of field QC sample collection are described below (USGS 2000).

Rinsate Blank. Prior to the start of sample collection activities for each sampling event, a rinsate blank will be generated by the laboratory that conducts decontamination of the peristaltic pump sampling equipment to ensure that the decontamination procedure is adequate. To the extent that field decontamination procedures are necessary, some of the rinsate blanks collected will be of these field procedures so that the overall frequency noted above is attained. Per the FSP, the rinsate blank will be held open in the sampler so it is exposed to the same conditions as the sample bottles.

Field Duplicate. A field duplicate sample consists of aliquots of the same composited sample that are equally distributed in two sets of sample containers. These samples will be analyzed identically to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

Integral. 2004. QAPP Addendum for Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

APPENDIX B
STORMWATER GRAB SAMPLING SOP

STORMWATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting stormwater grab samples from freshwater environments using a peristaltic pump and Teflon™ tubing.

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting grab stormwater samples from freshwater environments using a Teledyne/Isco (Isco) automatic sampler.

This SOP utilizes and augments some of the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). While some of these exact procedures are not used, because they are not necessary for this FSP, the clean techniques described in this guidance were used to assist in developing a series of procedures that will minimize the possibility for sampling contamination of samples. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by programs that follow these guidelines.

While the above procedures were intended for sampling for trace metals, using these procedures for organic compounds as well as conventionals (such as total suspended solids (TSS), dissolved organic carbon (DOC), and dissolved suspended solids) provides a means to minimize the possibility of sample contamination in general.

SUMMARY OF METHOD

Stormwater grab samples for standard chemical and conventional analyses will be collected using a peristaltic pump that is part of the Isco automatic sampler. The Isco sampler will be removed from the sampling location by the sampling team. The sampler case will be opened and the delivery tube will be removed from the bulkhead fitting. A clean Teflon lined tube (using the procedures described in Appendix A for the Isco intake tube) will be connected to the bulkhead fitting to collect the desired samples. The sampler will be put into "Grab" mode and the specified volume will be programmed into the sampler. Once activated, the sampler will purge and the grab sample will be collected into four 1-gallon jars.

The sampling team will seal the samples with Teflon lined caps, label, and package them as described in Appendix A for transportation to the LWG Field Laboratory. The sampling team will remove the grab sampling tube from the bulkhead fitting and reconnect the distribution tube and close up the sampler. The sampling team will re-deploy the sampler as described previously.

At the LWG Field Laboratory, the sampling team will combine the samples into a single composite for each event and samples will be filtered and prepared for laboratory

analyses. The compositing, filtering, and sample preservation will occur at the Field Laboratory as soon as possible after sample collection. The goal will be to conduct filtering within 24 hours of sample retrieval from the samplers. The samples shall be handled following the procedures described in the Chain of Custody SOP (Appendix F).

SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. The grab samples will be collected with the peristaltic pumps built into the Isco sampler deployed at sampling site. Only sampling containers and a short length of Teflon tubing will be required to collect the samples. Additionally, a cooler will be required to transport the samples to the LWG Field Laboratory. Additional equipment for the processing and filtering of samples is noted in the procedures and collection sections below.

PROCEDURES

EQUIPMENT DECONTAMINATION

Each sampling team will be responsible for preparing their equipment prior to the sampling event. The procedures described in Appendix A will be used to decontaminate sample tubing, mixing containers, and sampling jars including special procedures noted in Appendix A for locations were phthalate sampling is required.

STORMWATER SAMPLE COLLECTION

Clean Handling Techniques

The clean handling techniques are modeled after the “clean hands – dirty hands” method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean/dirty technique requires two or more people working together. At the field site, one person is designated as "clean" (C) and a second person as "dirty" (D). Although specific tasks are assigned at the start to C or D, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both C and D wear appropriate non-contaminating, disposable, powderless gloves (phthalate free vinyl gloves for locations where phthalate sampling is required) during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

C takes care of all operations that involve equipment that comes into contact with the sample, and under the covered portions of the automatic sampler, including the following responsibilities:

- Handles the stormwater sample bottles (removes and replaces)

- Handles sample bottles until they are placed and sealed into coolers
- Prepares a clean workspace in LWG Field Laboratory
- Sets the equipment (i.e., the sample bottles and the filtration and preservation equipment) inside the laboratory

D takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the samplers
- Removes samplers from catch basins, if necessary, and releases catches and lifts of sampler cover for C.
- Replaces cover and latches sampler covers
- Handles the tools, such as hammers, wrenches, keys, and locks
- Handles the single or multi-parameter instruments for field measurements.
- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.
- Sealed coolers.

Stormwater Sampling Procedures

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing as well as assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for recording stormwater field parameters.

The following procedures will be followed when collecting the water samples from the Isco samplers.

While the D person and assistant remove the manhole or catch basin lid, the C person will clear a work space and lay down a plastic sheet. The D person will place the sampler on the plastic sheeting and release the catches on the sampler and lift away the cover standing it on the plastic sheeting. The C person will inspect the inside of the sampler for signs of wear or debris. The C person will then remove the distribution line form the bulkhead fitting and install a Teflon line.

The D person or assistant will re-glove to operate the Isco sampler. The program running on the Isco sampler will be interrupted and the sampler placed into “Grab” mode. The D person shall program the volume of water desired (1 gallon) and start the sampler. The sampler will purge the lines several times and pause before delivering the sample. The process will be repeated to collect the additional 3 gallons required for analyses.

The C person will direct the flow of water into the sample containers. When complete the C person will then cap and label the sample bottle and place it a cooler with foam dividers. Once the samples have been properly secured, the C person will the sampling tube and reattach the distribution tube to the bulk head fitting and return the sampler to standby mode.

The D person will replace the cover and latch the fasteners. The D person and assistant will replace sampler in the catch basin and close and lock the lid if applicable.

SAMPLE PROCESSING

Once a stormwater sample container is properly closed, labeled, and then placed inside a cooler with foam dividers containing wet ice.

All samples are stored in sealed coolers with wet ice and transferred to the LWG Field Laboratory at the conclusion of the sampling event. Personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the sample containers with clean gloves (and phthalate free vinyl gloves in the case of phthalate samples), and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored weekly to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Sample Compositing, Filtering, and Transfer to Sample Bottles for Laboratory Analysis

At the LWG Field Laboratory, the sampling team will combine the samples into a single composite for each event following the transfer and mixing procedures described in Appendix A. The compositing, filtering, and sample preservation will occur at the Field Laboratory as soon as possible after sample collection. The goal will be to conduct filtering within 24 hours of sample collection.

Filtering will be conduced using disposable 0.2 micron glass fiber filters. Clean Teflon peristaltic tubing will be used to pump samples from the composite container through the filter, then through a similar outlet tube and directly into sample bottles. The glass fiber filters and tubing will be replaced with clean equipment between sampling locations to prevent any cross contamination between locations. It is anticipated that Teflon tubing will be decontaminated following procedures in Appendix A and then re-used for later

locations or sampling events. Glass fiber filters will be discarded once they have filtered sample from one location and event.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples will be collected during sampling following the frequency in the Section 3.8 of the FSP. The types field QC sample collection are the same as those for composite water sampling as described in Appendix A.

REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

Integral. 2004. QAPP Addendum for Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

APPENDIX C
SEDIMENT TRAP SAMPLING SOP

SEDIMENT SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting sediment samples from a catch basin using a sediment trap. A goal of this SOP is to ensure that the highest quality, most representative data be collected consistent with EPA guidelines.

SUMMARY OF METHOD

Sediment traps will be deployed at each location for a minimum target period of 3 months. Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is half full, sediments will be collected and archived and a clean bottle, filled with deionized water (to prevent floating) will be returned to the trap. This process will be repeated, and sampled sediments archived at the LWG Field Laboratory for additional later compositing until the trap deployment period ends.

Sediment samples will be capped with Teflon lined lids, labeled, sealed, and packaged appropriately for transport to the LWG Field Laboratory. At the field laboratory, the samples will be stored in the refrigerator.

Once the deployment period has ended, all sampled sediments (including archived aliquots) will be combined in one decontaminated stainless steel bowl using decontaminated stainless steel implements and thoroughly homogenized and subsampled in sample containers for chemical analyses.

SUPPLIES AND EQUIPMENT

The equipment required for the sediment sampling includes:

- Sediment sampler constructed of stainless steel and mounting hardware.
- 1-liter Boston Amber sample bottle with Teflon lined lid.
- Cooler with foam dividers for transporting samples.

Additional equipment may be required depending on the sampling location. Additional equipment for sample processing and homogenization are noted below in the procedures and collection sections.

PROCEDURES

EQUIPMENT DECONTAMINATION

Sediment Sampling Equipment Preparation

The sediment trap and mounting hardware will be constructed of stainless steel. Prior to installation, it will be cleaned using a scrub brush and lab-grade detergent, then rinsed in tap water, and allowed to dry. The sample bottles will be provided from the laboratory "Certified Clean" and filled with deionized water. (The sample bottles are filled with deionized water to prevent them from floating out of the sampler when there is water present in the catch basin.)

Sediment Extraction and Compositing Equipment

The following equipment will be used to extract sediment from trap bottles and homogenize them for subsampling into sample containers: glass flask, stainless steel implements (e.g., spoons), glass funnel, and stainless steel mixing bowls. This equipment will be decontaminated as follows:

- Dishwasher cycle (wash and tap water rinse).
- One spectro-grade acetone rinse
- Acid wash with at least 20 percent hydrochloric acid
- Rinse three times with DI water.

SEDMENT SAMPLE COLLECTION

Clean Handling Technique

The clean handling techniques are modeled after the "clean hands – dirty hands" method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean handling technique requires two or more people working together. At the field site, one person is designated as "clean" (C) and a second person as "dirty" (D). Although specific tasks are assigned at the start to C or D, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both C and D wear appropriate non-contaminating, disposable, powderless, and phthalate free vinyl gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes). C takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the sediment sample bottle
- Prepares a clean workspace

D takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the sampler
- Prepares the sampling equipment
- Handles the tools, such as hammers, wrenches, keys, and locks
- Measures and records the water depths and field measurements.

To control phthalate equipment contamination phthalate free vinyl gloves will be used and all other equipment coming into contact with samples will be glass or stainless steel. No additional procedures to minimize phthalate contamination will be employed, because any trace amounts of contamination caused would be unlikely to be measurable in urban sediment samples.

Sediment Sampling Procedures

Two persons are needed to conduct the sampling. To set up the sediment collection system and process the samples, the D person will remove the catch basin/manhole lid and the Isco sampler, if necessary, to provide access to the sediment trap. Using the confined space procedures in Appendix H, the C person will double glove and enter the catch basin, if necessary, to retrieve the sediment sample. After entering the catch basin the C person will discard the outer gloves and cap the sediment sample bottle with a Teflon lined cap. The C person will remove the sample bottle. The C person will pass the sediment sample to the D person, who will pack it a cooler for transport.

The D person will hand back down a new "Certified Clean" sample bottle that was filled with deionized water at the lab and sealed. The C person will place it the sampler. The C person will then remove the cap from the new sample bottle. The C person will exit the catch basin and the D person and assistant shall redeploy the Isco sampler and reinstall the catch basin lid.

SAMPLE PROCESSING

Once a sediment sample container is properly closed, labeled, it will be placed inside a cooler containing wet ice.

All samples are stored in sealed coolers with wet ice and transferred to the LWG field laboratory at the conclusion of sampling. Personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout

the sampling event. Once at the field lab, sample contamination is avoided by handling the double-bagged sample containers with clean gloves and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer unit is monitored weekly to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Sample Compositing and Transfer to Sample Bottles for Laboratory Analysis

At the LWG field laboratory, the samples will be removed from the sediment trap bottles and transferred to wide-mouth jars for storage in the freezer until the end of the sampling period. Due to the holding times, the samples must be frozen. The Boston 1-liter sediment trap bottles are susceptible to breakage if frozen with the sample as collected from the field. Transferring the sample, although potentially risking potential contamination, will allow much more reliable storage of the sediment sample.

Sediment removal from the sample bottles will require several steps as the bottle opening is approximately 1/2 inch in diameter. The sampling technician will decant most of the water from each sample bottle into a decontaminated flask. The technician will then swirl or stir the remaining water with a decontaminated stainless steel implement to mobilize the sediments. The technician will then pour the slurry into a decontaminated funnel with 2-5 micron filter paper and allow the leachate to drain to a decontaminated flask. Once the sediment has drained to a consistency allowing homogenization with a stainless steel spoon the sample can be lifted out by the filter material and placed into the decontaminated mixing bowl. The leachate water and the decanted water then can be used to rinse the sample bottle and remove the last of the sediments. Once the sample bottle have been emptied and the sediments have been added to the wide-mouth storage jar, a stainless steel spoon can be used to scrape off any sediments that have adhered to the filter material into the wide-mouth storage jar. The leachate water or decanted water can be used to rinse the filter material or add moisture if needed. Note that water content of the sediment trap samples is not a critical parameter, because the sediment trap does not represent any ambient condition in terms of water content. Any water extracted from the trap or added back will be inconsequential to the objectives of this FSP.

Once the deployment period has ended, all sampled sediments (including archived aliquots, which have been allowed to thaw in the refrigerator) will be combined in one decontaminated stainless steel bowl using decontaminated stainless steel implements and thoroughly homogenized and subsampled in sample containers for chemical analyses.

Sample analysis containers will be filled in the priority order shown in Table 2-3 of the FSP, except for the alternate priority for some locations as described in Section 2.3 of the FSP, until the bowl is empty.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples and frequencies are described in the FSP including:

- Field replicate, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Equipment rinsate blank for phthalates, 1 per 20 samples.

The types of field QC sample collection are described below (USGS 2000).

Rinsate Blank. Prior to the start of sample collection activities for each sampling event, a rinsate blank will be generated by the laboratory that conducts decontamination of the peristaltic pump sampling equipment to ensure that the decontamination procedure is adequate. To the extent that field decontamination procedures are necessary (e.g., for homogenization and sample processing equipment), some of the rinsate blanks collected will be of these field procedures so that the overall frequency noted above is attained.

Field Replicate. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

Per the FSP, field replicates will be generated by deploying sediment traps with additional sample collection vessels, and compositing the sediment from each half of the sediment trap collection vessels, separately, into two subsamples for analysis. Deployment of two vessels will only be possible at some of the locations, due to expected space limitations within the junctions. Consequently, after the location reconnaissance, the locations of the replicate trap deployment will be determined based on available space and other constraints noted above for sediment trap deployment. Replicate trap deployment will be conducted at sufficient locations to meet the 1 in 20 requirement. If this is not possible, the replicate analysis will be substituted with a replicate analysis consisting of homogenizing sediment from one vessel and splitting into two equal aliquots for analyses, at locations where sufficient volume is present, so that the 1 in 20 requirement. Analysis for laboratory QC samples will be conducted by dividing the total sediment collected from one sediment trap vessel at select locations with sufficient volume into three aliquots of equal mass for the laboratory analysis of the sample, matrix spike, and matrix spike replicate.

REFERENCES

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

APPENDIX C-2
STORMWATER FILTERING FOR SEDIMENT COLLECTION (BACK UP PROCEDURE)

HIGH-VOLUME STORMWATER FILTERING

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of sediments in filter media from high-volume water samples. Samples are collected to quantify sediment concentrations of targeted organic chemicals (e.g., PCBs, and pesticides) that are present and that could not be collected with the preferred sampling methods.

A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

SUMMARY OF METHOD

Large volumes of water will be pumped through glass fiber filter cartridges. This procedure retains particulates on the filters. A total volume of 1,000 liters will be pumped at each high-volume sample station at a flow rate of 2 liters per minute.

The water intake will be placed near the outlet of the catch basin with a long pole. Once the required volume for a particular analyte is established, the operator will run the pump at a fixed rate to collect a composite sample by setting the appropriate flow rate. (i.e., 2 liters per minute) and then monitor the system during the time period necessary for sample collection. The operator will also monitor the in-line pressure and replace filters when necessary. Samples will be collected using the "clean hands– dirty hands" method. Once the desired volume is pumped, the column assembly will be removed and any residual water will be drained out. The glass fiber filters will be removed as needed and placed in appropriate containers, labeled, placed in a polyethylene bag, and stored in a cooler containing ice.

At the analytical laboratory, filters will be extracted and analyzed individually. Extraction of filters will follow the laboratory SOP, which will be provided as an attachment to the QAPP Addendum for Stormwater Sampling.

SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. The equipment used for sediment sampling consists of a peristaltic pump and a sample tubing system composed of Teflon™ tubing and Swageloc™ stainless steel fittings. The filter unit is a high capacity spun glass fiber filter, 1 micron specified, manufactured by PALL Industries and pre-cleaned by Axys Laboratories. Other than the filters used for sampling particulates, no containers are used for sample collection. Additional equipment may be required depending on site requirements. Filters for sampling particulates will be prepared in the laboratory.

For each sampling station, glass fiber filters from the laboratory are prepared. The sample intake requires an approximate 4-meter-long Teflon™ tubing. The nominal filter pore size used will be selected in consultation with EPA and its partners prior to mobilizing to the field sampling location. A portable 3000-watt power generator will be used if 120 VAC electricity is not available at the sample site to operate the pump

PROCEDURES

EQUIPMENT PREPARATION

Before sample collection begins, the outside of sample containers and coolers are cleaned with a Phosphate free soap, rinsed with methanol, and finally rinsed with DI water. Sample containers are labeled with the date, sampling location, and a unique sample identification number using a permanent marker. Once cleaned and labeled, the sample containers are placed in coolers to keep from being contaminated during the sampling event. Date, site location, and sample identification numbers are noted on the field data sheet. A detailed site description with references to landmarks also is also provided.

Initial Setup

Prior to sampling, a clean Teflon™ intake line is then connected to an intake structure anchored in the stream of flow near the outlet of the catch basin. The discharge from the pump is discharged to the ground surface, down gradient of the intake to prevent mixing of the waste water with the sampled water. The sampling unit can then be plugged into the generator for power.

Decontamination Procedures

Before sample collection begins, the sampler is completely cleaned and tested for leaks and other mechanical problems. The sampler is cleaned chemically after every sampling day. Clean phthalate free vinyl gloves are worn during equipment decontamination. Once equipment has been cleaned, care should be taken to avoid touching or otherwise contaminating any surfaces that will come in contact with the sample water (e.g., inside surface of filter housings). Decontamination procedures are provided for the sampling unit, which also includes the filter housings and Teflon coated O-rings, as well as tongs and forceps.

Sampling Unit Decontamination

Decontaminating the sampling unit includes not only the pump unit but also the filter housings and O-rings. Procedures for decontaminating each of these parts are provided below.

Filter Housings and O-rings

- Remove filter housings from unit
- Wash housings and O-rings using a scrub brush and a phosphate free soap
- Rinse housings and O-rings with Methanol
- Rinse housings and O-rings with deionized water. Use cleaned forceps to hold O-rings while rinsing.
- Allow cleaned items to air dry on aluminum foil. Place O-rings in filter housings, and reconnect housings to sampling unit.

Sampling Unit

- Plug unit in (generator or wall outlet) and power up the sampling unit using the main toggle switch.
- Check that the flow control valves on top of the unit both point in the same direction. The arrows on the valve handles point to the filter housing that water will be drawn through.
- With the intake line submerged in phosphate free soap, press the <ON> button on the control panel to start the pump.
- Increase the RPMs of the pump until the pump is primed and water is flowing through the unit.
- Draw 20 liters of soapy water through the system, followed by 5 liters of deionized water.
- Place the end of the intake line in a wash bottle with approximately 3 L of methanol. Continue pumping until all of the solvent has been drawn into the tubing.
- Following the acetone rinse, place the end of the intake line in a wash bottle with approximately 3 L of deionized water.
- Continue pumping until all of the water has been drawn through the tubing.
- Place the intake line into water to be sampled (effluent stream) to push the solvent and deionized water through the unit. Continue pumping water for approximately 1 minute through the filter housing to thoroughly flush the system.

Tong and Forceps Decontamination

- Use a scrub brush with phosphate free soap to thoroughly clean the tongs and forceps.

- Rinse with deionized water, then with a small amount of acetone.
- After cleaning, store the tongs and forceps in a clean storage container until needed. Once used, place the utensils in a separate container used only for contaminated items that need to be cleaned before use.

SAMPLE COLLECTION

Clean Handling Technique

The clean handling techniques are modeled after the “clean hands – dirty hands” method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean handling technique requires two or more people working together. At the field site, one person is designated as "clean” (C) and a second person as "dirty" (D). Although specific tasks are assigned at the start to C or D, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both C and D wear appropriate non-contaminating, disposable, powderless, phthalate free vinyl gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

C takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the glass fiber filters
- Handles the discharge end of the stormwater sample tube or line
- Prepares a clean workspace
- Sets the equipment (i.e., the filtration equipment)

D takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Prepares and operates the sampling equipment, including the pumps and discrete samplers, peristaltic pump switch, and pump controller
- Handles the generator or other power supply for samplers
- Handles the tools, such as hammers, wrenches, keys, locks, and sample-flow manifolds
- Handles the single or multi-parameter instruments for field measurements.

- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.

Stormwater Sampling Procedures

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing. Samples are collected using the clean handling techniques.

Step 1 – Insert Glass Fiber Filter.

- Unwrap pre-cleaned PALL glass fiber filter. Do not directly touch any exposed surfaces of the filter. If the exposed filter comes in contact with anything other than the interior of the filter housing, the filter is discarded, and a new filter is used
- Insert glass fiber filter into filter housing.
- Once the filter is in place, reconnect the filter housing to the sampling unit and tighten housing with a wrench.

Step 2 – Reset Volume Meter

- Press <RESET> on the volume totalizer until the display reads 0.0.

Step 3 – Check Control Unit Settings

- Check the control unit to make sure the RPM light is on. If light is not on, press <STOP/RESET>.
- Make sure the FORWARD direction light is on. If the REVERSE light is on, press the <FORWARD/REVERSE> button.
- Make sure the PROGRAM light is NOT on. The pump will not operate in PROGRAM mode. If the PROGRAM light is on, press the <STOP/RESET> button.
- Use the UP and DOWN arrows to control the RPMs. A good initial starting point is the target flow rate of 2 liters per minute.

Step 4 – Begin Pumping

- Press <ON> to begin pumping. It may be necessary to increase the RPMs to get the pump started. It takes a few moments to get water flowing through the entire system.
- The moment that water is observed in the post-column line, reset the volume totalizer to 0.0. This is necessary to get an accurate volume measurement, because the totalizer will measure the water that was already in the lines from the cleaning process even though this water did not pass through the filter.
- Adjust the RPMs until the flowmeter indicates that the unit is operating at the optimum pumping rate of 2 liters/minute.
- Check all fittings to make sure there are no leaks.
- Note on the field data sheet the start time, pumping rate, and initial pressure on the system.

Step 5 – Check System

- Check the sampling unit periodically (at least every hour) to ensure unit is operating correctly. Check and record the volume filtered, flow rate, and pressure.
- If the pressure exceeds 15 psi, the glass fiber filter must be changed.
- If the flow rate has decreased, increase the RPMs to maintain the optimum pumping rate of 2 liters/minute. If increasing the RPMs does not help, the glass fiber filter must be changed.

Step 6 – Complete Sample Collection

- Operate the sampling unit continuously until the desired volume of water has been filtered. For most in-stream samples, 1,000 liters of water are pumped through the system. However, smaller samples may be collected, depending on expected chemical concentrations.
- Once desired volume has been filtered, cease pumping by pressing <STOP> on the control unit.
- Record stop time and volume filtered on the data sheet.
- Turn main switch on unit to off.

Changing the Glass Fiber Filter

The glass fiber filter must be changed if the pressure exceeds 15 psi, or if adjusting the RPMs does not increase the flow rate, by using the following procedure:

- Insert a glass fiber filter in the unused filter housing as described in Step 1.
- Press <STOP/RESET> to temporarily cease pumping.
- Record the stop time and volume filtered.
- Switch both directional flow valves to point in the direction of the filter housing containing the clean filter.
- Press <START> to resume pumping. See Sample Handling Procedures (below) to remove the used filter from the filter housing.

SAMPLE HANDLING PROCEDURES

The following procedures describe how the used filters must be handled once sampling is complete.

Glass Fiber Filters

- Remove the lower filter housing unit while being careful not to spill any of the particulate laden inside.
- Use clean tongs to remove the used filter from the housing and place the filter in aluminum foil. Note that more than a single filter and jar may be required if the sampled water is turbid.
- Label the aluminum foil wrapped filter with date and sample ID number.
- Place container on ice in a cooler.
- Record sample identification number on field data sheet.

SAMPLE PROCESSING

All samples are stored in sealed coolers with wet ice and transferred to the Field Laboratory at the conclusion of the sampling event. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples and frequencies described in the FSP for sediment trap samples will be used including:

- Field replicates, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Equipment rinsate blanks, 1 per 20 samples.

Rinsate Blank. Prior to the start of sample collection activities for each sampling event, a rinsate blank will be generated by the laboratory that conducts decontamination of the pump and filtering equipment to ensure that the decontamination procedure is adequate. To the extent that field decontamination procedures are necessary (e.g., for homogenization and sample processing equipment), some of the rinsate blanks collected will be of these field procedures so that the overall frequency noted above is attained.

Field Replicate. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field duplicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

REFERENCES

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

Appendix D
Flow Measurements

FLOW MEASUREMENTS

The purpose of this standard operating procedure (SOP) is to describe the procedures for installation of the Isco Area/Velocity Flow modules. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

SUMMARY OF METHOD

Flow will be measured with the Teledyne/Isco 750 AV Module (module). The module is an add-on enhancement to the Teledyne/Isco's 6700 Series Samplers that are being used to collect stormwater samples. The module provides the ability to collect flow proportional sample volumes or flow-paced samples. The sampler displays the real-time level, velocity, flow rate, and total flow provided by the module. The sampler records this data for later analysis.

The module is designed to measure flow in open channels without a primary device. (A primary device is a hydraulic structure, such as a weir or a flume, which modifies a channel so there is a known relationship between the liquid level and the flow rate.) Area velocity flow conversion requires three measurements: water level, velocity, and pipe dimensions. The AV sensor provides the level and velocity measurements. The pipe dimensions will be measured in the field and entered during module programming. The flow calculation is made in two steps. First, the module calculates the pipe cross-section (or area) using the programmed pipe dimensions and the level measurement. Then, the module multiplies the channel cross-sectional area and the velocity measurement to calculate the flow rate.

The sampler will be programmed to use the customary U.S. units, such as feet (depth), cubic feet per second or gallons per minute (flow, depending on size of the contributing basin), and gallons or millions of gallons (volume, depending on the size of the contributing basin). The sampler will be programmed to record flow data at 5-minute intervals. These data will be periodically downloaded throughout the course of the sampler deployment (as determined by data storage capacity) and entered into the project database.

In addition, data on rainfall will be obtained from various existing established rain gauge stations around the Portland area. These data will be used to make sampling decisions throughout the course of the sampling and to understand flow results for data reporting.

SUPPLIES AND EQUIPMENT

The equipment consists of a flow meter module, a sensor and carrier bracket to attach the sensor to the outlet pipe.

PROCEDURES

EQUIPMENT PREPARATION

Mounting equipment such as slip rings, nuts and bolts, brackets will be washed with warm soap water using a brush to remove any oil, grease or other residue from the manufacturing process. They will then be rinsed with spectro-grade acetone and then with tap water and allowed to dry. A warm oven could be used to speed drying.

When installing the brackets in the field at the sampling sites, it may be necessary to drill holes or use powder actuated tools to set studs, weld, or use other means to attach the sampling hardware that may create some debris that could become a contaminant source. After the studs are set or other procedures are complete, the work site will be scrubbed with a brush to remove any debris and rinsed with deionized water before the sampling hardware (intake screen) and AV sensor is mounted.

The sensor carrier bracket will be installed into the outlet pipe with an expandable ring so that the sensor will be located at the bottom of the pipe. The diameter of the pipe will be measured and noted for programming the Isco sampler. The flow meter sensor will be connected to the carrier and the cable will secured so that when the sampler is installed in the catch basin, the cable does not become kinked. The sampler will be turned on and allowed to self check. The installer will enter the programming mode and enter the diameter of the pipe. The installer will measure the depth of water in the pipe and adjust the sampler offset to match the measured value. The sampler will be prepared for the sampling team to install the clean sample bottles and deploy the sampler as described in Appendix A.

DATA COLLECTION

Data will be downloaded when water quality samples are collected. When the sampler is removed from the catch basin and the cover is removed a Rapid Transfer Module will be plugged in and data collected. The data will also be downloaded prior to disconnecting the power source when batteries must be changed. The data can also be downloaded via the cellular modem module. The data will not be erased and will be allowed to overwrite, in case there is a problem downloading the data. (The sampler has adequate memory such that there should be capacity to store the entire data record for the sampling period.)

Data will be downloaded from the Rapid Transfer Module at the LWG field laboratory and imported into a database using the Isco data management software.

Appendix E
Field Forms

Site Reconnaissance Form
Chain of Custody/Lab Analysis Request
Sediment checklist
Stormwater checklist

Appendix F
Chain of Custody SOP

CHAIN OF CUSTODY

The sampling team leader or other designated field sample custodian is responsible for all sample tracking and chain-of-custody procedures until sample custody is transferred to the laboratory.

Custody procedures in the field are as follows:

- Record all field and sample collection activities (including sample identification number, collection time and date) in the field logbook. While being used in the field, the logbook remains with the field team at all times. Upon completion of the sampling effort, the logbook should be reproduced and then kept in a secure area.
- Complete a chain-of-custody form whenever samples are being transferred or removed from the custody of field sampling personnel. A sample form is provided in Appendix E. Record each individual sample on the form. Include additional information to assist in sample tracking such as collection date and time, number of containers, and sample matrix. The chain-of-custody may also serve as the sample analysis request form, with the required analysis indicated for each individual sample.
- Sign the form and ensure that the samples are not left unattended unless secured.
- Store, pack, or ship samples as described in the appropriate SOP. Place the original completed chain-of-custody form in a sealed plastic bag inside the shipping container. A copy is retained by the shipping party.
- Complete a separate custody form for each individual shipping container or a single form for all samples in multiple shipping containers in a single shipment, with the number of containers noted on the custody form.
- Attach completed custody seals to any shipping container that will be sent to the laboratory by delivery service or courier. Delivery personnel are not required to sign the custody form if custody seals are used. Custody seals are used to detect unauthorized tampering with the samples. Gummed paper or tape should be used so that the seal must be broken when the container is opened. The laboratory sample custodian (or other sample recipient) will establish the integrity of the seals.
- The laboratory custodian (or other sample recipient) acknowledges receipt of the samples by signing, dating, and noting the time of transfer on the chain-of-custody form. The condition of the samples and any problems or irregularities (e.g., cracked or broken bottles,

loose caps, evidence of tampering) should also be recorded. Return a copy of the completed custody form to the project manger or designated sample coordinator.

The laboratory will designate a sample custodian who is responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples. Specific laboratory chain-of-custody procedures should be in writing, included in the laboratory QA plan, and approved prior to beginning sampling and analysis. Laboratory custody procedures should include the following:

- A designated laboratory person initiates and maintains a sample tracking log that will follow each sample through all stages of laboratory processing and analysis.
- The laboratory tracking log includes, at a minimum, the sample number, location and type of storage, date and time of each removal, and signature of the person removing or returning the sample.
- The final disposition of the sample is recorded.

Complete and correct chain-of-custody is essential to ensure and demonstrate sample integrity. Errors in entering information or transferring custody can result in analytical or data reporting errors. Inaccuracies or errors in sample tracking and custody records can compromise data usability, particularly as legal evidence.

Quality control procedures include the following:

- Allow adequate time to take accurate and complete field records and to carefully complete chain-of-custody forms.
- When possible, work in pairs or more to complete the chain-of-custody form and check for accurate information entry.
- Complete all custody records in ink; errors should be neatly crossed out and corrected and initialed by the person making the change.
- Immediately notify the project manager of any deviation from required custody procedures.

Environmental samples are packed in a manner to reduce the chance of sample breakage, ensure sample integrity, and prevent material leakage and potential exposure to hazardous materials in the event of breakage. Samples are packed in a sturdy container with adequate packing material to prevent breakage. Ice is included to maintain sample storage conditions. Samples are transported by field personnel or shipped via courier or

common carrier. Shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24).

All preserved samples should be shipped as soon as possible after completion of sampling. This minimizes the number of people handling samples and protects sample quality and security.

Upon completion of final sample inventory by the field sample custodian and completion of chain-of-custody, samples are packed as follows:

- Use a leak-proof, sturdy cooler that can withstand rough treatment during shipping. The cooler's drain should be securely plugged and sealed with duct tape.
- Place the sample bottles tightly inside the in the shipping container:
- Fill any empty space in the shipping cooler or box with packing material so that the jars are held securely.
- Place the original completed chain-of-custody form in a sealed plastic bag and place it inside the shipping container. The form should be securely taped to the inside of the cooler's lid.
- If required to meet sample storage requirements, fill the cooler with wet ice or blue ice packs. A temperature blank (provided by the laboratory) should be packed in each cooler.
- Seal shipping containers securely with packing or duct tape.
- If the shipping containers will be transported by anyone other than the person who completed and signed the chain-of-custody form, attach completed custody seals so that the shipping containers cannot be opened without breaking the seal.
- A Fragile label may also be attached to reduce rough handling of the samples.
- Label the shipping container with all appropriate information (name of project, time and date, responsible person and company name, address and phone) to enable positive identification.

Packed containers may be delivered to the laboratory or storage facility by field personnel, courier, or common carrier (FedEx, UPS). However, any outside carrier or courier service must provide a delivery receipt. The carrier or courier must also ensure delivery time, if holding time and storage conditions are critical. Unless arranged in advance, shipping charges should be prepaid by sender to avoid confusion and possible rejection of the package by the laboratory.

The adequacy of handling and shipping procedures is reflected in the condition of the samples upon receipt by the laboratory:

- No jars containing water samples, sediment samples, or filters are cracked or broken.
- There is no evidence of sample leakage.
- Measuring the temperature of the temperature black indicates that correct storage conditions have been maintained.

The sample custodian or other designated person is responsible for confirming that copies of all shipping documents completed in full and correctly are on file.

Appendix G
Laboratory Protocol for Extraction and Analysis of Large Volume Water Samples
[This appendix may no longer be necessary and this will be verified with the labs.]

Appendix H
Confined Space Health and Safety Plan Addendum

Anchor Environmental L.L.C., has officially accepted the Integral Round 2 health and safety plan (acceptance letter on June 18, 2004); Anchor intends to continue to use it for general health and safety measures. The following sections provide supplemental details of confined space entry policy and procedures.